# Biorenewable Systems

**TSM/ABE 325**

Sierra Kubik, Allie Oder,
Jeffrey Freier, and Adam Weber

# Impact of Energy Crops on Soil Management and Erosion

## Introduction

- What are energy crops?
- Energy crops [Figure 1] are perennials that require less cultivation and inputs than conventional crops, and are low maintenance harvest crops used for biofuels. [3]
- "Energy crops are considered to be a less intensive form of agriculture." [1]


**Figure 1. An example of different energy crops used in the state of Iowa.** [4]

- Why are energy crops important?
- [U.S. Congress, Office of Technology Assessment, 24]
  - Heavier deeper root system:
    - Releases more carbon into soil creating productive
    - Higher water retention
    - Enhances soil nutrients
    - Intercept leaching fertilizers or other agricultural chemicals.
  - Erosion control managed by crop residue (organic matter), soil type, and slope of land.

## Background Information

- Provides a physical buffer reducing rain and wind impact resulting to less soil erosion.

| Crop | Average erosion rate (Mg ha$^{-1}$ yr$^{-1}$) |
|---|---|
| Average U.S. crop | 18.1 |
| Corn[a] | 21.8 |
| Soybeans[a] | 40.9 |
| Wheat[b] | 14.1 |
| Perennials[c] | 0.2 |
| Hayland[c] | 0.2 |
| Disturbed forest at first | 2–17 |
| Average forest rotation | 2–4 |
| Short-rotation wood[d] | 2 |

**Figure 2. Is a representation of erosion rates of various crops.** [3]

- Low residue crops like soybeans, rarely produce enough residues to maintain adequate soil cover compared to high residue crops like miscanthus & sugarcane.
- High residue can contribute to soil organic matter by chemical, physical, and biological properties.
- ***"Converting a corn farm of average size to switchgrass could save 66 truckloads of soil from erosion each year."*** [2]
- Energy crops are currently a small proportion of the total energy produced from biomass each year, but is set to grow in the coming years. [5]
- "Perennial energy crops require less maintenance and fewer inputs than do annual row crops, so they are cheaper and more sustainable to produce."[2]

## Opportunities and Constraints

**Opportunities:**

- Energy crops could have a substantial impact on the environment and soil conditions of fields all over the heartland.
- ~15% of Iowa's corn crop areas are not profitable. [4]
- Energy crops most likely won't increase profitability, but they will make an impact on the environment by decreasing runoff in water, nitrogen, and phosphorus. [4]
- Costs of planting energy crops are less expensive than installing terraces. [4]
- "Several million dollars of federal incentives are available through the 2002 Farm Bill to develop advanced technologies and crops to produce energy, chemicals, and other products from biomass." [2]

**Constraints:**

- Convincing growers that energy crops can improve farm ground compared to traditional crops.
- Energy crops are high in silica, which creates slag when combusted.
- Making a profit on energy crops is very difficult.
- Improvements in technology are needed to increase the efficiency of harvesting and producing fuel from the harvested crops.

## Potential Solutions

- Energy Crops can be planted in areas where conventional crop are consistently not profitable. [2]
- Crops like miscanthus should be planted in valleys where soil runoff is problematic. [Figure 3]

**Figure 3. An example of erosion in a low-lying area** [6]

- More research and money need to be allocated to energy crops because cultivation and use of the energy crop post-harvest is still at the forefront of research today. [2]

## References

[1] U.S. Congress, Office of Technology Assessment, Potential Environmental Impacts of Bioenergy Crop Production-Background Paper, OTA-BP-E-118 (Washington, DC: U.S. Government Printing Office, September 1993)

[2] Daniel G. De La Torre Ugarte, Marie E. Walsh, Hosein Shapouri, and Stephen P. Slinsky. The Economic Impacts of Bioenergy Crop Production in U.S. Agriculture, 1999.

[3] J. W. RANNEYANDL. K. MANN. "Growing Energy on the Farm: Biomass and Agriculture." *Union of Concerned Scientists*. N.p., n.d. Web. 10 Dec. 2015.

[4] Heaton, Emily. "Iowa State University Energy Crop Research." TSM 325. Iowa State University. 20 Oct. 2015.

[5] RALPHE.H.SIMS. "Energy Crops: Current Status and Future Prospects." Global Change Biology. N.p., n.d. Web.

[6] Favis-Mortlock, Dave. "Soil Erosion Site: Water Erosion." Soil Erosion Site: Water Erosion. N.p., Feb. 2005. Web. 10 Dec. 2015.